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Wood, William Heaword

Economics in railroad
problems

Media, Pa.

1923

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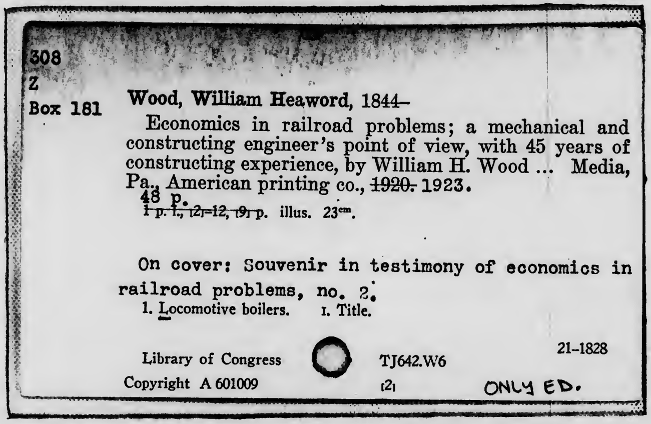

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Box 181

Wood, William Heaword, 1844-

Economics in railroad problems; a mechanical and constructing engineer's point of view, with 45 years of constructing experience, by William H. Wood ... Media, Pa., American printing co., ~~1920.~~ 1923.

48 p.
~~1 p. l., [2]-12, [9] p.~~ illus. 23cm.

On cover: Souvenir in testimony of economics in railroad problems, no. 2.

1. Locomotive boilers. I. Title.

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SOUVENIR IN TESTIMONY OF

ECONOMICS IN RAILROAD PROBLEMS

No. 2

By WILLIAM H. WOOD
Media, Del. Co., Pa.

Member:—A. S. M. E.
M. B. M. Asso.
N. Y. R. R. Club
Western R. R. Club
Am. Academy of Political and Social Science, Etc.

AN INTERESTING STUDY FOR BANKERS, TRUST COMPANIES, INSURANCE COMPANIES, STOCKHOLDERS AND THE PUBLIC

ECONOMICS IN RAILROAD PROBLEMS

A Mechanical and Constructing
Engineer's Point of View with 45
Years of Constructing Experience

BY WILLIAM H. WOOD : MEDIA, DEL. CO., PA.

FEBRUARY 1923

American Printing Co., Media, Pa.

Railroad Problems

(Copyrighted)

Mis-representation is often the cause of millions of dollars in money value being wasted annually. Take the report of the boiler makers at the last convention, being based on their experience, in regard to side plates being corrugated in locomotive fire-boxes. Such a report is liable to be confounded with construction, that had never come within their experience.

When practical engineers or when practical boiler makers get together to discuss construction which is identically the same, they do not often disagree. They do disagree on new laws governing construction, not understood, then it is, that mis-representation occurs, as referred to in this case.

It would b well for all to remember, that there never was fire box construction made, same as I tested. I quote you from the book of Mechanical Engineering of Power Plants, 1908, by Professor Hutton, page 119. He states, "Figure 120 shows the fire box with corrugations on the plain elements. THIS IS DUE TO WM. H. WOOD."

This fire box construction is the first that was ever made to neutralize stresses in a fire box and tube plates in boiler construction, which I did construct, with temporary tools, and which were tested out in practice for 4 years on an Eastern Railroad. This is the bone of contention, and is responsible for the wasting of 15,000,000 tons of coal annually since 1908, on our railroads.

The writer has studied all that has been done and that which is referred to in the experience of the boiler makers, going back to Reuben Wells' time, when he corrugated side sheets, changing the base of the mud ring to suit the corrugations. This, together with the Vanderbilt freak arrangement, (Fox corrugated furnaces,) and the Le-Cour plates that was tested out on the Northwestern and other roads, and lastly, the Jacob Shubert boxes on the Sante Fe. The Le-Cour Plates, instead of disposing with stresses were setting up stresses, which could not be controlled. All these constructions referred to are absoluely foreign to my construction of equalizing stresses by balanced construction.

For Boiler Makers or Superintendents of Motive Power to boycott me with their experience as against mine, is Cruel and Unjust, and will come to the daylight, when my construction is made Standard, and until then no relief can be had in any improved locomotive boiler construction, where the fuel saved will pay for the upkeep.

A circular was printed in 1908, which will show what I anticipated, bfore building the boilers and making the tests. The test proved the most fratifying work of my 45 years experience.

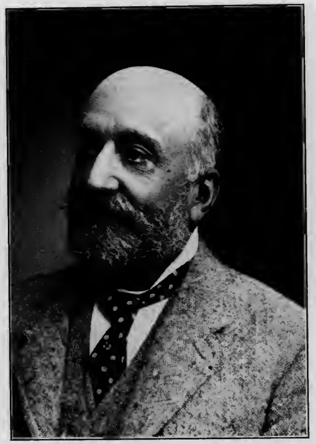
Respectfully submitted,

WM. H. WOOD,

Mechanical & Constructing Engineer, Media, Del. Co., Pa.

June 20, 1922.

Aug. 12, 1925 3 L 5.
BOT



Wm. H. Wood.

The Author gives out this Information to show what a Constructing Engineer, by introducing new construction, had to contend with, the incentive being to reduce Locomotive Maintenance and Operation. Not being a railroad man, the difficulty, in the shape of opposition, is not creditable by ordinary business interests. It is to be hoped, reasonable interests will be centered in the statements from reliable connections.

To waste 15,000,000 tons of coal annually on our Railroads could hardly be considered good judgement, when it is known it could be saved by the latest type of Locomotive Boiler Construction.

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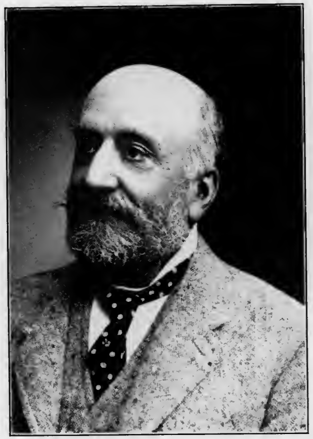

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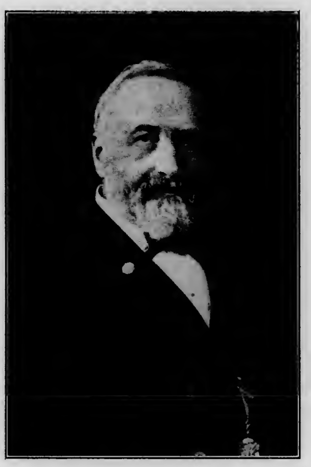


THE LATE DR. ANGUS SINCLAIR, OF NEW YORK,
who devoted his entire life to locomotive practice.

He was an advocate for the Wm. H. Wood improvements in locomotive boilers, on account of the flexibility, as will be seen from his address, 1909, before the New York Railroad Club (about 300 members present), when he said as follows:

"The engineering world has striven for eighty years to restrain expansive forces of metal. They tried to resist the irresistible and to do so they made their sheets and staybolts heavier and heavier. There is an engineering aphorism that says, 'When an article breaks it is too weak,' but that does not apply to staybolts and side sheets of boilers, for the heavier you make them the more liable they are to break; and it seems now that the only remedy is to give flexibility instead of rigidity to these parts. This is a lesson to the whole railroad world—to be prepared to give flexibility instead of stability. I think, gentlemen, it is going to be one of the most important movements that has ever happened in the railroad world, and is going to save untold trouble from leaky fire boxes and the terrific expense of continuously renewing a thing that appears to be just right and goes to destruction apparently as soon as the work is done."

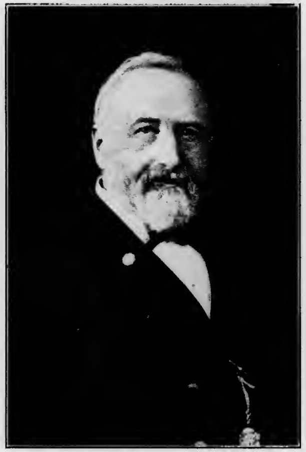
Railroad Problems on Locomotive Boilers

By William H. Wood, Constructing Engineer,
Media, Del. Co., Pa.

Enormous sums have been spent and are being spent on the locomotive engine, with a view of saving coal, and which really add to motive power expenses. Reducing operating expenses by improvements added to the engine part of the locomotive, can only be assumed theoretically.

The prime mover is the boiler, improvements of which are known, and if they had been made Standard, would have reduced operating expenses 50 per cent., also reducing accidents with locomotive boilers to a minimum, on account of the construction being stronger and the stresses to which locomotive boilers are subject, being neutralized. This would keep the locomotive in service, indefinitely, instead of the construction used, which only remains in service for a short period, before repairs are actually needed.

Attempts have been made to relieve the rigidity and the breaking of stay bolts, by the use of so called, flexible stays, which in reality are a Menace to the safety of the boiler.



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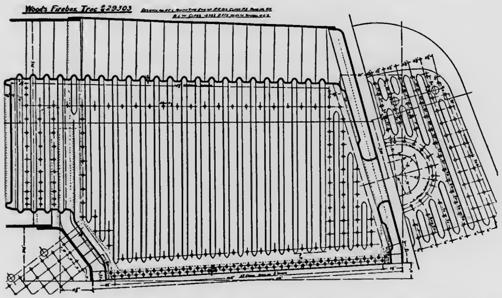
LATEST PACIFIC TYPE OF LOCOMOTIVE FIRE-BOX COMBUTION CHAMBER



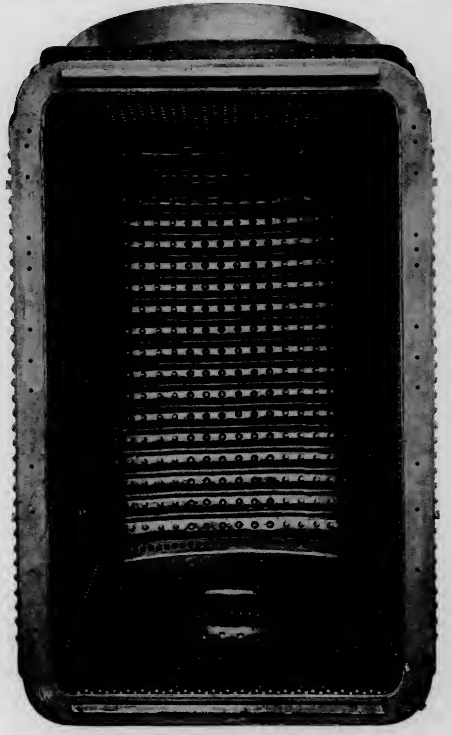
Why sacrifice this construction, which saved Coal and repairs on test of 4 years? Correct records of Test and Inspectors' Charts are carefully filed for future reference

The Test Referred to as Deflection Test is as Follows:

N. B.: THE TEST REFERRED TO AS DEFLECTION TEST IS AS FOLLOWS:

"On June 23rd, we took a ¼″ thick plate, 35″ wide by 96″ long, corrugated with 6″ centers according to your heaviest corrugation, and placed it on two blocks about 83″ apart. After so doing we placed on the center of said plate a total weight of 16,000 lbs. This weight was not distributed over the entire plate but was confined to a distance of 14″ each side of the center. We also took another plate of the same dimensions, with the exception of being ½″ thick and not corrugated. This we placed in the same manner on the blocks, placing the load on the same given area, and found that it would only bear up 4,190 lbs."

RAILROAD PROBLEMS IN LOCOMOTIVE BOILERS



INSIDE OF FIREBOX

This illustration shows my firebox internally as made with the improvised tools by me, for test purposes only, in consolidation boilers

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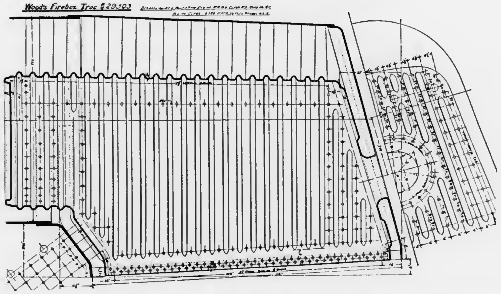

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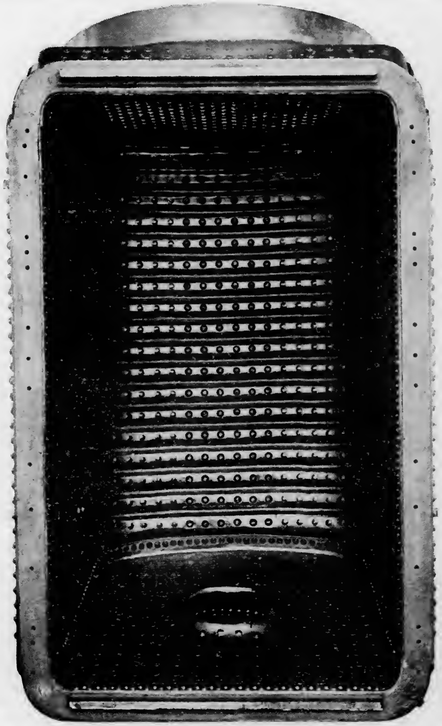

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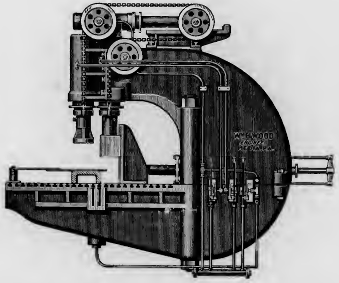
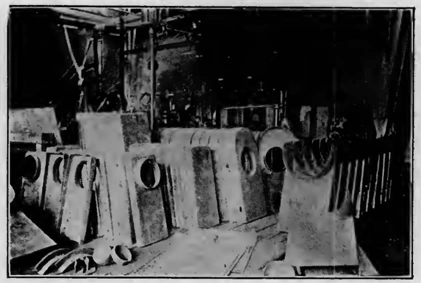
RAILROAD PROBLEMS



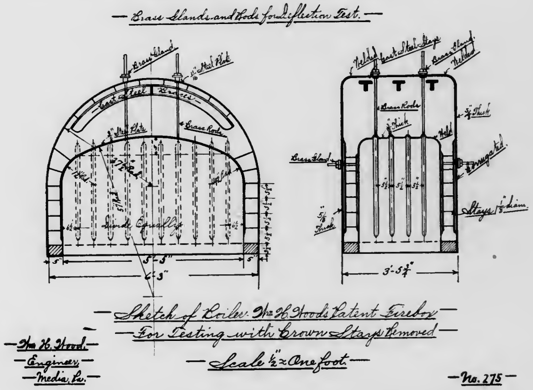
This cut shows the Press on which the Fire Boxes were corrugated and bent up with the improvised tools, Plates 3/8" thick, 18'10" long, and 9'8" Broad when Flanging was begun



FLANGING DONE ON THIS PRESS

FOR CONSTRUCTION TEST

This illustration shows a fire box made for the purpose of testing with the crown stays removed. Arranged for Measuring Deflection under test

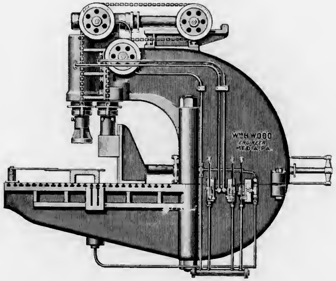


Expansion and contraction is now a recognized enemy to locomotive fireboxes, as was explained by the writer, and which is done away with by the shallow corrugations in the complete flexible firebox system.

LARGE ENGINES.

As far back as 1915, there was published a statement in the *Railway Review*, in which it was clearly shown what these large engines were doing in the shape of paying for themselves, so as to conform with the ideas that had been produced on the different roads, and it was shown by Mr. Willard A. Smith, Editor of the *Railway Review*, at the Western Railroad Club, that, from an investigation which had been made on one of the western roads, these monster engines only performed a duty in hauling trains 4½ hours out of every 24 hours. They spent in the roundhouses and in the shops the balance of the time in being repaired, and he stated this condition is no different from any other large system.

The condition of which Mr. Smith speaks is the result of "bright ideas," which are not in keeping with known scientific improvements by outside engineers of experience.



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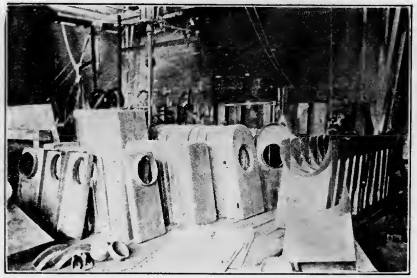

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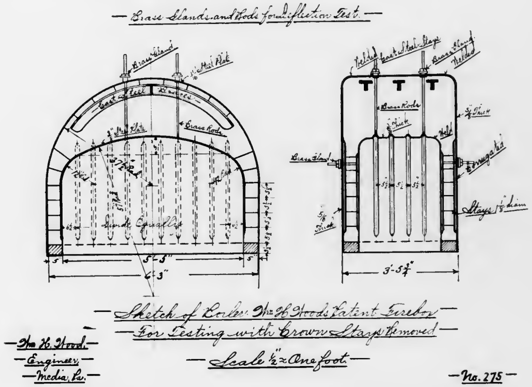

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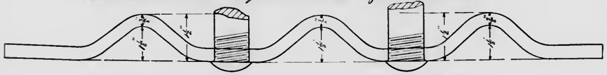
SECTION OF IMPROVED BOILER CONSTRUCTION

Note:—No Corrugations made over 1¼" deep and all Stays inside—
—Fire Boxes are on Flat Surfaces, same as in Regular Fire Boxes.—



—Full Size Section of Flanging as made after Testing—
—For Wm H. Woods Loco. Fire Boxes.—

—Mr Purcells Sketches showing Corrugations as illustrated—
—in the Railroad Administration Report would look better—
—if they were correct.—

Section of corrugation to correct misrepresentation in trumped-up report.

This illustration shows the latest type of corrugated oil heater sent out by the Bureau of Fuel Economy, at Washington

Many types of heaters are in use. The one shown in figure 7, is illustrated because it incorporates correct engineering principles in its design, as has been stated under the notes on heat transmission, and in practice has shown excellent rates of heat transfer. Many other makes of heaters are giving good service.

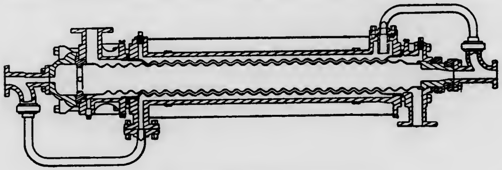


FIGURE 7.—Heater for heating oil fuel by steam.

GREATLY INTERESTED

Mr. E. H. Harriman, President of the Union Pacific System, telegraphed me to meet him on the day he was to sail for Europe, and I was there to meet him, but, was informed, he was too ill to see me, regarding Boiler Construction, but said he would see me on his return, and it is only too well known that his collapse, on his return prevented this.

A Study of the Summary of the Tests as Furnished You by the N. Y. C. Officers Shows

(a) 10.78 per cent. more work done for 9.3 per cent. more coal used at 1.86 per cent. greater speed, which, by a generally accepted formula, **reduces the tractive power** by an equal amount for a locomotive of that class at the speed given, consequently increasing the amount of fuel necessary to exert the same drawbar pull.

(b) The boiler efficiency is shown as 2.6 per cent. greater than the competing boiler in an otherwise exactly similar engine, while the developed boiler HP is shown as 1.54 per cent. less, based of course on the water used.

(c) The locomotive efficiency is shown as 7.77 per cent. greater with drawbar pull almost exactly similar to that exerted by the competing locomotive.

(d) The consumption of fuel per square foot of grate surface is shown as 6.31 per cent. less. The consumption per HP is 5.37 per cent. less, the water evaporated per drawbar HP 4.39 per cent less.

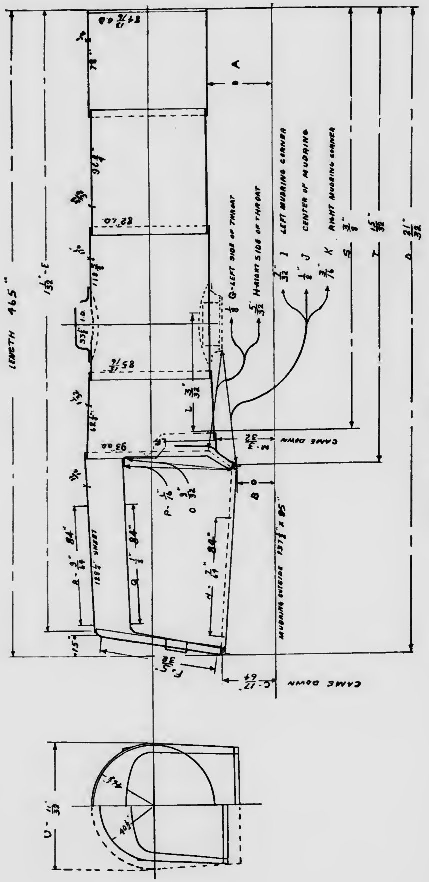
(e) The evaporation per square foot of heating surface is shown as 1.266 per cent. greater. The evaporation per lb. of fuel 2.5 per cent. greater.

The foregoing clearly shows that from the basis of fuel used, the Wood boiler **was more economical** as regards evaporation while it is also clear that the steam supplied by it was more efficient **being saturated to a less degree** thus enabling the locomotive to **exert equal power with 14 lbs. per square inch less pressure.**

These points as shown by the summary justify the claim that the **circulation around the firebox** is better and the increased efficiency as regards evaporation appears to **follow the increased heating surface in firebox.**

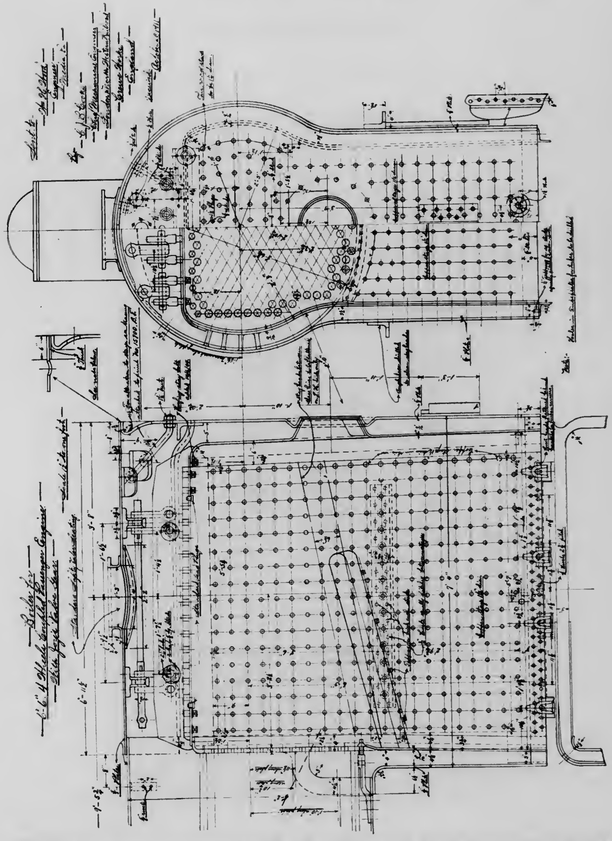
With **increased facility for manufacture** together with decrease in circulation obstructions, **even better results** may be looked for, so supplementing the original aims **for elimination of constructional defects** in the **present design of locomotive boilers.**

J. W. HARKOM,
Mem. Can. Soc. C. E.,
Consulting Engineer.



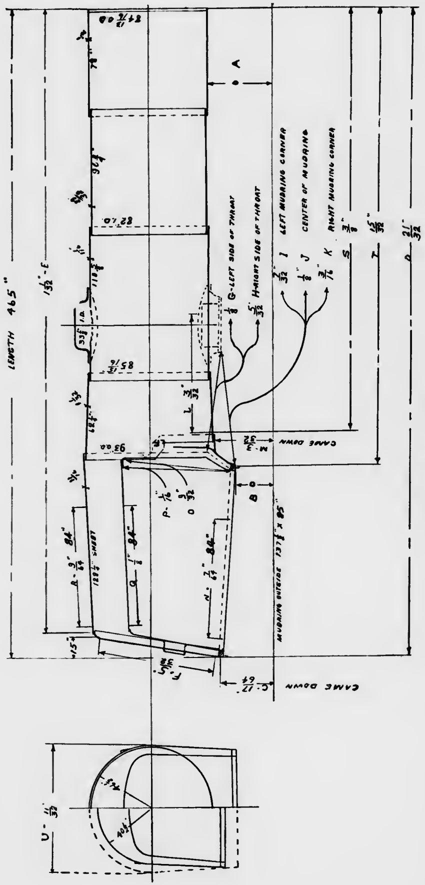
Expansion Test

This Diagram shows the direction of the expansion as published in the *Railway Journal*, on Page 20 in February, 1914, and it will be easily understood how the action works as is indicated by the arrows and the measurement shows the expansion of back end of box which occured from starting the fires, until the steam pressure was reached, on a New York Central Mallet engine, the test being made by Mr. E. J. Allen.



This drawing shows backhead and fire door formation, and is that referred to as a corrugated firebox, tested out, and reported as a failure in England, by Motive Power, in the trumped up reports. This drawing represents incorrect staying, which was the real cause that it did not work longer than 7 years. This statement by Motive Power would not be taken as correct, by any boiler maker or Engineer who examined my fire box drawings. Executives might have done so, by receiving incorrect information.

INTENTIONAL SECOND EXPOSURE



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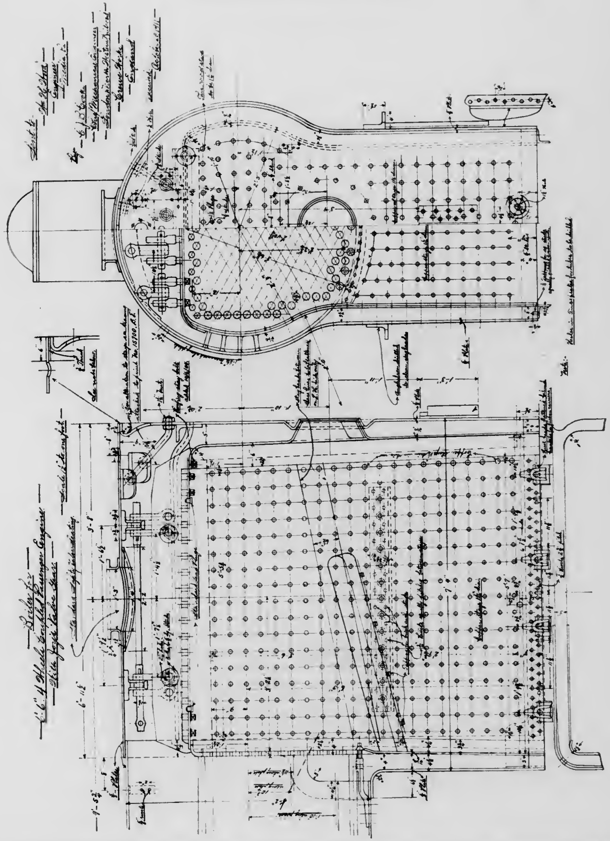

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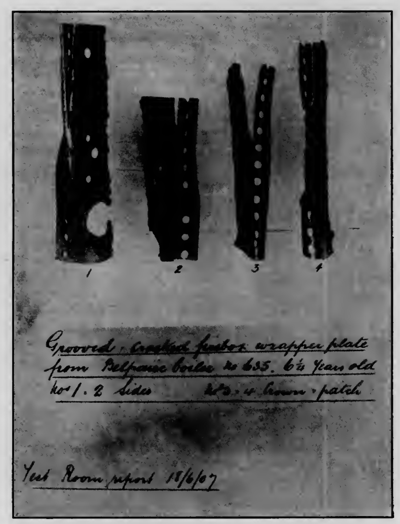
Railroad Problems in Locomotive Boilers

This cut represents the back head form of flanging, referred to by Railroad Executives, as given out to them, to be complete corrugated Fire Box made and tested in England. This information was *in error,* for no such construction as I have gotten up, ever was tried out before I made and tested it. See Page 1, and Drawing of Fire Box on proceeding page.



Grooved & cracked firebox wrapper plate from Belpaire boiler No 635. 6¼ Years old
Nos 1. 2 Sides   Nos 3. 4 Crown & patch

Test Room report 18/6/07

Latest Type of Locomotive Boilers

My fire box and tube plate formation embodies a commonsense and practical arrangement and is the only formation, by which expansion and contraction in locomotive fire boxes is neutralized. At the same time it increases fire box and tube plate heating surface 20%, prevents broken stay bolts leaking tubes and mud rings, cracked tube and side sheets, adding to the strength of the fire box structure.

The Boilers Tested had no flexible stays in them.

SAFETY OF LOCOMOTIVE BOILERS

In a copy of the Cummins Railroad Bill, Calendar No. 231, S.3288, on page 26, sent to me by the Honorable A. B. Cummins while the subject was being debated in Congress, it stated as follows:

> (j) "The functions and powers created and conferred by 'An Act to promote the safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their locomotives with safe and suitable boilers and appurtenances thereto,' approved February 17, 1911, and all Acts amendatory thereof and supplementary thereto."

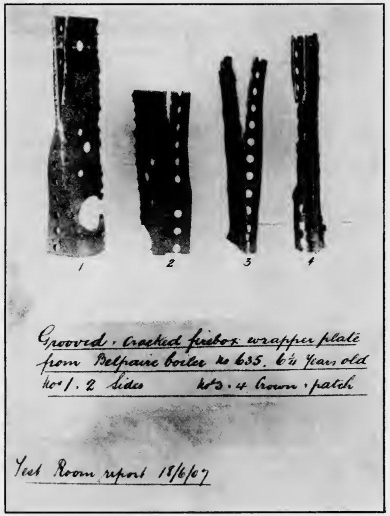
The Bill was afterwards changed in the Conference Report as Agreed to H. R. 10453. It is evident the management of the railroads objected to this statement referred to above being incorporated in the Bill from the fact that the flexible boiler is shown to be eight times stronger than the rigid type now in use.

It might be construed by the before mentioned Act that the boilers on locomotives, as constructed, might be questioned as to their safety on account of the increased size and power.

My Boilers referred to in this test had only 12 per cent. extra heating surface.

Railroad Problems in Locomotive Boilers

This cut represents the back head form of flanging, referred to by Railroad Executives, as given out to them, to be complete corrugated Fire Box made and tested in England. This information was *in error,* for no such construction as I have gotten up, ever was tried out before I made and tested it. See Page 1, and Drawing of Fire Box on proceeding page.



Grooved, Cracked firebox wrapper plate from Belpaire boiler No 635. 6¼ Years old
Nos 1. 2 Sides Nos 3. 4 Crown, patch

Test Room report 18/6/07

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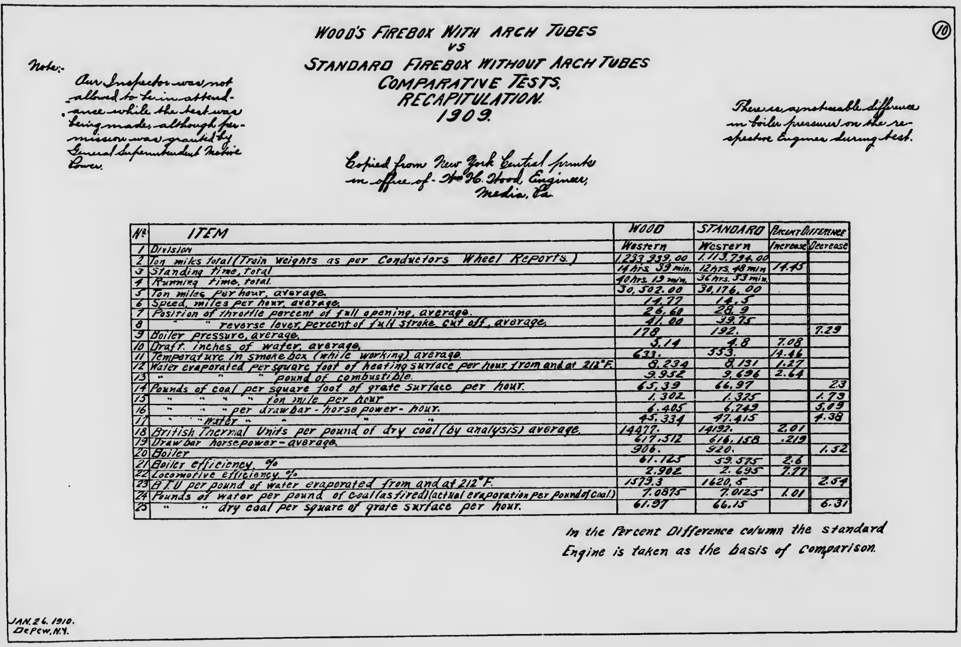


⑩

WOOD'S FIREBOX WITH ARCH TUBES
VS
STANDARD FIREBOX WITHOUT ARCH TUBES
COMPARATIVE TESTS.
RECAPITULATION.
1909.

Note:- Our Inspector was not allowed to be in attendance while the test was being made, although permission was granted by General Superintendent Motive Power.

There is a noticeable difference in boiler pressures on the respective Engines during test.

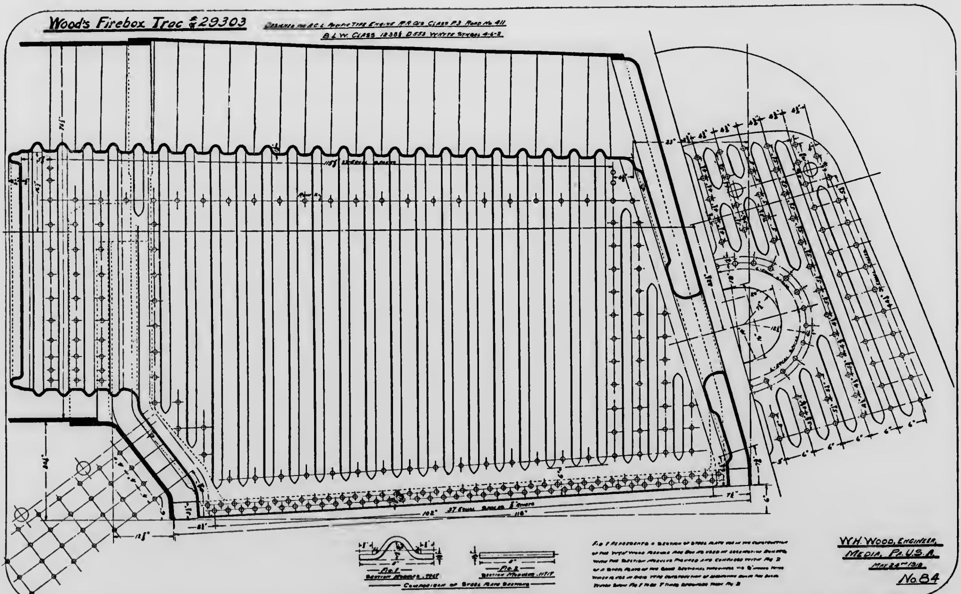
Copied from New York Central prints
in office of- Wm. H. Wood, Engineer,
Media, Pa.

Nº	ITEM	WOOD	STANDARD	PERCENT DIFFERENCE	
				Increase	Decrease
1	Division	Western	Western		
2	Ton miles total (Train weights as per Conductors Wheel Reports.)	1,233,939.00	1,113,794.00		
3	Standing time, total	14 hrs. 39 min.	12 hrs. 48 min	14.45	
4	Running time, total.	40 hrs. 19 min.	36 hrs. 53 min.		
5	Ton miles per hour, average.	30,502.00	30,176.00		
6	Speed, miles per hour, average.	14.77	14.5		
7	Position of throttle percent of full opening, average.	26.60	28.9		
8	" " reverse lever, percent of full stroke, cut off, average.	41.00	39.75		
9	Boiler pressure, average.	178	192.		7.29
10	Draft, inches of water, average.	5.14	4.8	7.08	
11	Temperature in smoke box (while working) average.	633.	553.	14.46	
12	Water evaporated per square foot of heating surface per hour from and at 212°F.	8.234	8.131	1.27	
13	" " " pound of combustible.	9.952	9.696	2.64	
14	Pounds of coal per square foot of grate surface per hour.	65.39	66.97		2.3
15	" " " " ton mile per hour	1.302	1.325		1.73
16	" " " per drawbar-horse power-hour.	6.405	6.749		5.09
17	" " water " " " "	45.334	47.415		4.38
18	British Thermal Units per pound of dry coal (by analysis) average.	14477.	14192.	2.01	
19	Drawbar horsepower-average.	617.512	616.158	.219	
20	Boiler "	906.	920.		1.52
21	Boiler efficiency, %	61.125	59.575	2.6	
22	Locomotive efficiency, %	2.902	2.695	7.77	
23	B.T.U. per pound of water evaporated from and at 212°F.	1579.3	1620.5		2.54
24	Pounds of water per pound of coal (as fired) (actual evaporation per pound of coal.)	7.0875	7.0125	1.01	
25	" " dry coal per square of grate surface per hour.	61.97	66.15		6.31

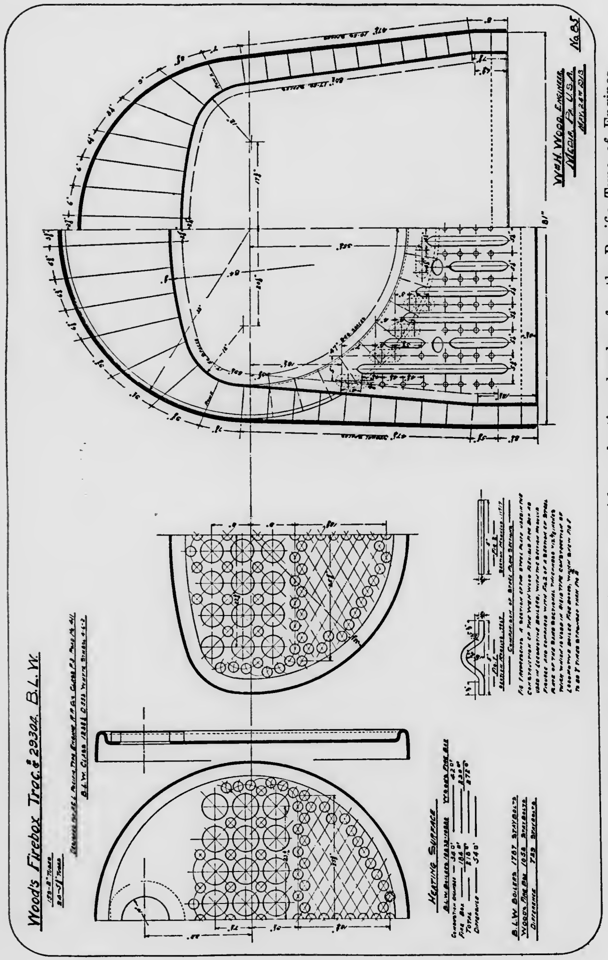
In the Percent Difference column the standard Engine is taken as the basis of comparison.

JAN. 26. 1910.
DEPEW, N.Y.

"Note"—My Boilers referred to in this Test had only 12 per cent. Extra Heating Surface.


Wood's Firebox Trac #29303
DESIGNED FOR A.C.L. PACIFIC TYPE ENGINE R.R. Co's CLASS P3 ROAD No. 411
B.L.W. CLASS 12388 D553 WHYTE SYMBOL 4-6-2
W.H. WOOD, ENGINEER,
MEDIA, PA. U.S.A.
MAY 24th 1910
No. 84

Latest Type of Wm. H. Wood's Loco. Fire Boxes with combustion chamber for the Pacific Type of Engines.


Wood's Firebox Trac. # 29304 B.L.W.
Heating Surface
Wm. H. Wood, Engineer, Media, Pa. U.S.A.
No. 85

Latest Type of Wm. H. Wood's Loco. Fire Boxes with combustion chamber for the Pacific Type of Engines.

Statement

The Author of this Pamphlet did not ask the railroads to let him improve locomotive boiler construction; it was their representative Boiler Makers who asked him to do so, after presenting their troubles with present construction, on the Blackboard, at the Buffalo Convention in 1905, so that he could see just what they had to contend with.

I studied two years, to balance boiler construction, so that I might be sure that I was right before I presented my plans to them, which I did, at the Cleveland Convention, two years later. It was there I met Mr. J. F. Deems, then General Superintendent of Motive Power of the New York Central Railroad, and it was from him that I afterwards obtained an order to make three of their largest consolidation boilers to be applied to three engines working on their road. These are the boilers, with the fireboxes and tube plates, which were made with the improvised tools referred to in this pamphlet and Pamphlet No. 1.

Extract Letters Endorsing this Safety Device for Locomotive Boilers

1909 to 1915.
SAFETY FIRST.

THIS DEVICE MAKES BOILERS ABSOLUTELY EIGHT TIMES STRONGER THAN LOCO. BOILERS AS USED AND WHICH ARE SERIOUSLY WEAKENED BY THE USE OF FLEXIBLE STAYS.

SOME THREE HUNDRED LETTERS HAVE APPEARED IN ENGINEERING AND RAILROAD PAPERS ENDORSING THIS DEVICE in connection with Loco. Boilers.

LOCO. BOILERS, will be found in extract letters attached.

No replies from Railroad Superintendents of Motive Power or Master Mechanics against the device have been published.

What Expert Mechanical and Constructing Engineers, Boilermakers and others say about the SAFETY DEVICE COMPLETE CORRUGATED LOCO. FIRE BOXES AND TUBE PLATES FOR

Latest type of Pacific Loco. Boilers with combustion chambers recently designed by Loco. Co., with this device, show a gain of fifty-four square feet of extra heating surface with same grate area, nearly twenty per cent. of the total surface of the Fire-Box where FORTY-FIVE PER CENT. OF WORK IS DONE, beside making BOILER EIGHT TIMES AS STRONG AS THOSE MADE WITH PLAIN PLATE. This device makes the Boiler STRONGER AND SAFER, with less DANGER to LIFE from explosions.

ATLANTIC COAST LINE RAILROAD CO.

Wilmington, N. C., August 19, 1915.

Mr. Wm. H. Wood, Pres.,
The Wm. H. Wood Loco. Fire Box Co.,
Media, Pa.

Dear Sir:

I have your letter of August 13 enclosing letter signed by Mr. Samuel M. Vauclain, under date of April 30, 1915, relative to your firebox which you are desirous of using in our new engines.

I, also, have your letter addressed to Mr. Smith under date of August 7, and you will please consider my letter as an answer to his also, as he is away on his vacation.

As you already know, we have one of your *fireboxes in service* in one of the *10-wheel engines,* and so far it has given a *good performance,* and we were *considering using your firebox in the ten new engines* which were just contracted for, but now find that it is impossible to do so, as we were limited on the appropriation for the new engines and your firebox would increase the cost above the amount which we are allowed.

We *regret very much* that conditions are such that we cannot now specify your firebox.

Yours truly,
Signed: Willard Kells,
Asst. Gen'l Supt. Motive Power.

Memorandum

Baldwin's have made drawings of these Pacific Boilers using our fireboxes and tube plates, and they show a gain of 54 square feet of firebox heating surface in them, which equals practically 20 per cent. of the total firebox and combustion chamber heating surface. This should look good to any superintendent of motive power if he values the saving that can be made on this road, as there is no saving in the use of flexible bolts and especially in view of the fact that the Master Mechanics' Association some few years ago reported that firebox heating surface was equal to ten to one of the tube surface. This was afterwards corroborated in the Spectacular Test at Coatesville in 1912.

The extra cost named by Baldwin for their boilers to substitute on our fireboxes, etc., was $175, and if flexible stays were left out, as they are not required in our boilers, the price would be the same as the boiler now used.

The Chief Locomotive Boiler Inspector of the Interstate Commerce states they have reduced the fatalities from explosions, etc., in the Locomotive Boilers in two, 60 per cent., which has been done by carefully inspecting and ordering the boilers out of commission to be repaired, but the great expense in maintaining Locomotive Boilers is *still going on,* and the acknowledged weakness remains in the structure *just the same* and at the expense of the stockholders of all raidroads.

The great cost of maintenance which has been brought to light recently in the *Railway Review* and other Railway Papers showing the total maintenance cost as absorbing thirty-three per cent. of the gross earnings of the railroads, can be remedied to a great extent by the device controlling a safer construction. It is demonstrated in actual practice that the *present evils* in the construction in the boiler *still exist.*

The Interstate Commerce formed this division for Locomotive Boiler Inspection for the better safety of the Locomotive Boilers. Therefore, this device must appeal to its inspectors, in asmuch that it makes a boiler *eight times stronger than those at present used, consequently safer,* and, at the same time, welcomes a reduction of at least 729 stays, which would otherwise have to be cared for, for they are a perpetual *trouble* and menace to the safety of the boiler; any other position taken by the inspectors would be working on anti-dated experience which at present fosters a loss to all railroad stockholders, which has been publicly shown to be the case, as previously referred to herein.

INTERSTATE COMMERCE COMMISSION,
DIVISION OF LOCOMOTIVE BOILER INSPECTION,
WASHINGTON.

March 10, 1914.

Mr. Wm. H. Wood,
Media, Del. Co., Pa.

Dear Sir:

This is to acknowledge receipt of your letter of February 20, and also of March 3.

I regret very much that the numerous other duties which I am required to perform frequently cause a considerable delay in answering correspondence, which must be my only apology for the delay in replying to your letter.

In regard to whether or not the Government can recommend or require the adoption of a standard locomotive fire box or any other standard equipment, will say that that matter is up to Congress and they, no doubt, could, if they desired, pass laws which would require standardization of anything which they may desire. However, the present locomotive boiler inspection law does not confer such authority on this division. Therefore, all we can do is to make every effort to enforce the existing laws, the efficiency of which has been demonstrated by a 60 per cent. reduction in fatalities in two years.

I am very sorry I was not here when you called, as I would be very glad to discuss with you at any time when it can be arranged, matters which might promote safety in the operation of locomotives, but if the adoption of a standard fire box is desired, it will be necessary to appeal to Congress for additional legislation, as the present laws clearly do not give us that right.

Yours very truly,
Signed: Frank McManamy,
Chief Inspector.

April 3, 1915.

Baldwin Locomotive Works,
Philadelphia, Pa.

Gentlemen:

We are expecting a large order will be placed in the very near future for locomotives with our boilers, and we wish to know if the statement made by your Mr. S. M. Vauclain, "that if fifty-one hundred or more were ordered, you would put up a special shop at Eddystone to manufacture our fire boxes and tube plates?"

Mr. Vauclain made the statement to our Mr. Wood at the time after he had worked so hard to try and prevail on Mr. Gibbs, G. S. M. P., Pennsylvania Railroad, to have fifty of the engines you then had orders for made with our fire boxes and tube plates. We particularly wish to have you confirm this while we are in conference with several railroad presidents. If the orders we refer to are given, there will be doubtless a rush to have our boilers on other roads.

Referring to Mr. Est and Mr. Nicholas' visit here to consult with Mr. Wood, in regard to the Northern Pacific engines which are still in abeyance. The committee appointed on making the boxes made some tests and reported very favorably to us as to being able to produce them at practically little difference in cost, owing to the very large reduction in stays, etc., in our boilers.

Waiting to have your confirmation, at the earliest possible date, we are,

Yours truly,
THE WM. H. WOOD LOCO. FIRE BOX & TUBE PLATE CO.

THE BALDWIN LOCOMOTIVE WORKS.
Samuel M. Vauclain,
Vice-President.

Philadelphia, Pa., April 30, 1915.

The Wm. H. Wood Loco. Fire Box & Tube Plate Co.,
Media, Del. Co., Pa.
Attention of Mr. Wm. H. Wood.

My dear Mr. Wood:

We have had before us for quite a while your correspondence concerning the furnishing of Wood fire boxes in large quantities and you have referred to various consultations between yourself and people from our plant, including the writer.

We now quote you for fire boxes 84¼″ wide and 114″ long, and in all respects suitable for the locomotives recently built for the Nashville, Chattanooga & St. Louis Railroad, blue print of which we attach.

We have compared the cost of your fire box with that of a normal fire box of this description without any flexible stays, but fitted with the ordinary type of stay bolt. If you were to order from us one hundred fire boxes of this type, we would make an extra charge for boilers so constructed and your fire box applied, of $330 each, exclusive of such royalty as you might wish to have us add for you. With the royalty mentioned heretofore, namely, $125 for each boiler added, then our price over and above a normal Baldwin boiler would be $455 for each engine. It must be borne in mind, however, that we now seldom build any normal fire boxes; most all large engines are equipped with a certain number of Tate flexible stay bolts. On these particular boilers there were 499 flexible stay bolts in each, making a total additional cost of $275, so that if your boxes were used, compared with the normal type of box including this number of Tate flexible stays, then the price charged, including the royalty of $125, would be $180 for each engine.

We are of the opinion that after we would have made one hundred of these fire boxes that this price could be somewhat reduced; in fact, at this writing we feel that we could afford to build a boiler with your fire box and ordinary stay bolts in place of a boiler with normal fire box and Tate flexible stays at a cost not to exceed the amount of royalty which you might demand

Very truly yours,
Signed: Samuel M. Vauclain,
Vice-President.

It would follow that if the boiler mentioned was fitted with double the number of flexible stay bolts, that is, 998 instead of 499, it would add to its cost and, therefore, be in favor of the Wood boiler, costing less by $95.00, inclusive of *royalty as specified*. Again, if the same boiler had a full installation of flexible stays it would still be in favor of the Wood boiler costing less by about $750.

NEW YORK CENTRAL & HUDSON RIVER R. R.,
GRAND CENTRAL STATION,
MOTIVE POWER DEPT.

New York, June 8, 1909.

Mr. Wm. H. Wood,
Media, Pa.

Dear Sir:

As per our conversation of June 3, I am pleased to write that the Wood boilers in New York Central engines 2481, 2490 and 2494 are performing satisfactorily, but you will of course appreciate that they have not been in service long enough to enable us to arrive at any conclusions in regard to cost of maintenance, as compared with other boilers, neither are there at hand any reliable figures concerning coal consumption.

Yours truly,
SIGNED: J. F. Deems, Gen'l S. M. P.

664 Main Street, Buffalo, N. Y., March 8, 1910.

Mr. Wm. H. Wood, Engr.,
Media, Del. Co., Pa.

Dear Sir:

I have inspected engine 2481 fitted with Wm. H. Wood Loco boiler daily for one year within twenty days of the time she has been in service. There have been no broken stays, no leaky mud rings, no leaky tubes, only those caused at dump-outs. I have examined the boiler internally and find all in first class condition. In engines 2490 and 2494 there were no cracks in tube plates, as was reported, nor have I found any in 2481. I have examined all *three internally with torch and chisel* and found all in best condition.

Respectfully submitted,
SIGNED: Fred H. Snell, Loco. Expert.

Letter of J. W. Harkom, Consulting Engineer.

Richmond, Quebec, November 20, 1909.

I most heartily congratulate you on the success your improvements in fire box and tube plates are apparently securing. It was a big undertaking, and only one who was fully conversant with the possibilities of modern flanging and the methods of *doing* it could have attacked the problem as you have.

Letter of Mohammed Hafez, Egyptian State Railways and Telegraphs.

Egypt, Tanta, January 11, 1909.

I have the greatest pleasure to acknowledge receipt of your book showing your patent fire box. From my point of view I consider the idea of corrugation is very highly excellent and it does worth the approval of the Mechanical World's great men, having to relieve them of several troubles. In my opinion a boiler fitted with your patent fire box will do very well.

Letter of J. W. Eviston.

Milwaukee, January 21, 1910.

I have been riding Locos. for the past three years, and having made a study of Loco fire boxes and tube setting, I am very well posted on the disadvantages of the present fire box; therefore, your fire box and tube plates appeal to me very strongly.

Letter of E. W. Pratt, Master Mechanic, Chicago & Northwestern R. R. Co.

Missouri Valley, Iowa, February 10, 1908.

I am very glad that you are starting out so well with your very ingenious fire box and tube plates.

Letter of F. A. Myer, Southern Railway Co.

Washington, January 25, 1910.

The fire box looks good to me.

Letter of John Pomfret, American Locomotive Co.

Paterson, N. J., February 2, 1910.

Considering the construction of the fire box as a whole, I think you have originated some very good ideas which are worthy of test and execution.

Letter of John D. Isaacs, Consulting Engineer, Union Pacific System.

Chicago, June 10, 1909.

Mr. E. H. Harriman, on subject of locomotive fire boxes, has been referred to me. If you will send me complete description and detail, I will be glad to give the matter careful consideration.

Letter of J. W. Heltzel, Erie Railroad Co.

Meadville, Pa., January 22, 1910.

It is true that the paragraphs in your circular printed in red speak for themselves, but not so much as does the fire box. It is evident that the Wood fire box and tube plates cannot help but meet with absolute success for the reason that the design is in accord with the expansion and contraction of a fire box working under the most unavoidable conditions. The writer has studied the expansion and contraction of the fire box for some time, and on the strength of data obtained has become an advocate of the Wood Loco. Fire Box.

Letter of Angus Sinclair, *Railway Locomotive Engineering*.

New York, June 28, 1909.

Concerning your inquiries about the Wood patent fire box and tube plates, I have no doubt that the Egyptian Railway would make no mistake in applying the corrugated fire box to their locomotives.

Letter of J. A. Dornberger, Norfolk & Western Railway Co.

Roanoke, Va., May 28, 1909.

Personally, Mr. Wood, the more I think of your invention the more favorably I am impressed with it, and I predict for you and your associates an abundance of success.

Letter of J. T. Goodwin, American Locomotive Co.

Richmond, Va., May 24, 1909.

Since going over your prints at Louisville, looking into the merits of your patent, I am inclined to believe you have an interest that will appeal to all loco. users. I can say to you with all candor, I think your fire box has come to stay.

Letter of R. E. Smith, Gen'l Supt. M. P., Atlantic Coast Line R. R.

Wilmington, N. C., July 3, 1909.

I have, as I think you will admit, evinced a desire to make a test of your fire box, which seems to me to be constructed on correct principles. Should we enter the market for new equipment, I will expect to take this matter up again with a view of having a portion of the engines, at least, equipped with your boiler.

Letter of H. J. Small, Gen'l Supt. M. P., Southern Pacific Railway Co.

San Francisco, July 22, 1909.

We have given this some consideration in the recent past, with the result that our Chicago office has arranged for the Union Pacific to make trial of this fire box on their locomotives, the result of which will be reported to the various Harriman lines.

Letter of David Crowther, M. E., published in *Railway Age Gazette.*

I consider Wm. H. Wood's Loco. Fire Box an ideal box, and it should appeal to all mechanical men for locomotive boilers.

Letter of R. Quayle, Supt. M. P., Chicago & Northwestern R. R. Co.

Chicago, January 5, 1910.

Now on the subject of your letter; we have thought very favorably of the fire box, and have believed that it was mechanically correct.

Letter of J. C. Chambers, Supt. M. P.

Rocky Mount, N. C., September 9, 1909.

I am sorry that our people did not go ahead with the fire box as suggested by Mr. R. E. Smith. It is probable, and I hope you will receive the order for the fire box at a later date.

Letter of George A. Miller, Supt. M. P., Florida East Coast Ry.

St. Augustine, Fla., November 12, 1908.

As this is a new type of fire box construction, I am interested in your improved fire box, as it seems to me it ought to overcome some of the defects inherent in the rigid type of fire box as now built.

Letter of M. O. O'Connor, C. & N. W. Railway Co., Lines West of Missouri River.

Missouri Valley, Ia., January 24, 1908.

You have a most complete fire box, as each sheet in fire box, as well as front tube sheet and flues, are provided for to release uniformly the expansion and contraction, which, in my opinion, will eliminate, to a great extent, the trouble heretofore experienced by the rigid flanges and uneven expansion of fire sheets. The more I look at your plan of fire box and tube sheets the better I like it.

Letter of John Tinhe, M. M., Minneapolis & St. Louis R. R.

Minneapolis, Minn., July 14, 1909.

I think it a grand opportunity for such roads as the New York Central, the Pennsylvania, the Baltimore & Ohio or some of the other great lines to develop this box of yours.

Letter of G. S. McKee, Supt. M. P. and C. E., Mobile & Ohio R. R.

November 19, 1908.

Note you are going to furnish the New York Central lines with these boilers, and assure you that, in my opinion, this development will be a great improvement in the mechanical world.

Letter of G. W. Taylor, Supt. M. P., San Antonio & Arkansas Pass Ry.

February 15, 1909.

Expect in a month or two to take matter up with you, either for fire box or complete boiler.

Letter of W. F. Buck, Supt. M. P., Atchison, Topeka & Santa Fe R. R. System.

February 17, 1909.

I am glad to know your expectations have been realized relative to expansion and contraction. The increase of thirty per cent. in heating surface and a decrease of 350 stay bolts is quite an item in your favor.

Letter of J. W. Kendrick, Second Vice Pres., Atchison, Topeka & Santa Fe Ry. System.

January 3, 1908.

I will watch with interest, the boilers which will have your patent improvements, and will be glad if you will send me report as to result obtained after these have been given a fair trial.

Letter of Richard Reeves.

Hampum, Pa., January 3, 1909.

Let me congratulate you on your fire box. It looks to me that you have solved the problem to get rid of stay bolts.

Letter of R. Quayle, Supt. M. P., Chicago & Northwestern Ry. Co.

Chicago, October 28, 1909.

For your information, we have recommended to our people one of your fire boxes, and hope to get a favorable reply in the next few days, and then we will not have to depend on the tryouts of others, but will have it in our own field, where we will know for ourselves, and if it is all right, we can probably aid you in giving information to others who wish to give it a tryout.

Letter of J. J. Connolly, Supt. M. P., Duluth South Shore & Atlantic Ry.

Marquette, Mich., November 3, 1908.

May state I was much interested and put in considerable time looking over your patent corrugated fire box at Atlantic City last June. I presume you do not figure on changing your box, as the life of the box would be much longer as it is now.

Letter of C. J. Baumann, N. Y., N. H. & Hartford R. R.

New Haven, Conn., February 2, 1910.

Am very grateful to you for keeping me informed of your ideas, which have impressed me very much, especially the tube sheets, as I believe all our trouble with oblong holes and checks in top of flue sheet is caused by tubes being too close together and too near heel of flange. For this reason I think you have a very good tube plate, also there is a chance for tube plate to work all ways.

Letter of J. Fremond Murphy, Mech. Expert, Hudson Terminal.

New York, N. Y.

Have been watching with interest the development of your improvement in fire box construction. I consider your type of tube sheet a decided improvement.

Letter of F. W. Wood, Pres., Maryland Steel Co.

Sparrows Point, January 14, 1909.

The construction of your locomotive fire box seems to me admirably designed to overcome expansion and stay bolt troubles.

Letter of F. C. Cleaver, Supt. M. P., Rutland R. R. Co.

Rutland, Vt., August 21, 1909.

Your patent fire box strikes me as a good thing. I would favor, when we have any engines built, trying one or two of these boxes.

Letter of Mr. Hix, Seaboard Air Line.

While we are not able to equip our new locomotives with the "Wood" fire box, our mechanical people are making investigation with a view of using them on some of our older equipment when the fire boxes need renewing, in order to give them a trial.

Letter of Geo. Schuhmann, M. E., Gen'l Mgr., Reading Iron Company.

Reading, Pa., June 25, 1907.

I have received circular of your improved locomotive boiler, which I have examined carefully, and while I am not a locomotive builder, still as near as I can see, the elasticity of the tube sheet certainly must help the trouble experienced with the flues, and I congratulate you on your invention, and wish you success.

Letter of Wm. McIntosh, Supt. M. P., Central R. R. of N. J.

Jersey City, October 12, 1908.

I was very much interested in the type of fire box when I examined the one you had on exhibition at Atlantic City, last June, and further on account of having had experience with the earliest type of corrugated fire box applied to locomotives in this country, while I was in the employ of the Chicago & North Western R. R., over twenty-five years ago.

Letter of George F. Baer, Pres., Phila. & Reading R. R. Co.

December 28, 1908.

I have every confidence in your capacity as an engineer and, without making any personal examination, I have no doubt your patent will prove valuable.

Letter of A. S. Vogt, Mech. Engr., Penna. R. R. Co.

Altoona, Pa., April 13, 1908.

Received book relating to your improvements in locomotive boilers. I have read this with a great deal of interest, and thank you for sending it to me.

Letter of F. M. Patterson, M. E., V. P. and Engr., Patterson-Allen Engineering Co.

Jersey City, May 24, 1909.

I note with a great deal of pleasure the fine performance of your fire box. I can see nothing ahead of this proposition but a brilliant success.

From letters of Mr. H. A. Gillis, M. E., formerly Gen'l Supt. of American Loco. Co.

Richmond, Va.

Have been looking into the matter of the Wood Locomotive Fire Box pretty carefully, and up to the present time have not found any trouble with mud of any kind.

At present time I am satisfied that the Wood Fire Box is the greatest step in advance, both as to economy of maintenance, saving of time and economy in fuel, that has been introduced in many years.

Regarding the Wood Fire Box and Tube Plates, I think that the matter has sufficient merit for you to try it out on your own road for yourselves and not take the report of others. The increased heating surface I am confident will be of considerable value to any railroad which is burning a low grade of coal, such as lignite.

I have talked to several engineers in regard to the Wood Fire Box and Tube Plate and find general opinion seems to be in favor of it.

Personally, I think Wood has a good proposition and Mr. McNaughton and Mr. Vauclain, and others are of the same opinion.

Regarding fuel saving, I feel that it does save a considerable amount of fuel not only because it should do this theoretically, on account of the increased heating surface, but on account of my examination of the fire boxes on the N. Y. Central and my trips on the engines with these boxes. I was able to satisfy myself that there was considerable economy in fuel.

Engine 2490, fitted with the Wm. H. Wood Fire Box and Tube Plates, was put into service over nine months and left Buffalo with eighty-six cars, mostly loaded with coal, in a blinding snow storm and arrived with her train at Syracuse on schedule time, something which is a very rare occurrence on the N. Y. Central Lines under similar conditions.

The real things which you have accomplished, in my mind, is first a uniform distribution of stresses over a very large area and at a very large number of points. You have also greatly increased the heating surface of the boiler. Both of these are great steps in advance.

Letter of S. M. Vauclain, Gen. Supt. Baldwin Loco. Works.

Philadelphia, September 10, 1909.

Have received the reports from your Locomotive Expert in regard to the workings of engines fitted with your boiler. These reports are very interesting and I thank you for sending same to me.

Letter of J. E. Muhlfeld, Gen. Supt. M. P., Baltimore & Ohio R. R. Co.

Baltimore, November 5, 1908.

We believe the proposed corrugation may reduce the strains brought about by expansion and contraction and eliminate the trouble of fire box flue cracking, or at least increase the life of the sheet.

Letter of W. F. Buck, Supt. M. P., Atchison, Topeka & Santa Fe Ry., Albuquerque Division.

April 13, 1909.

I am very much obliged to you for the prices you quote for furnishing a complete back end, also front tube plate for use in one of our Santa Fe type locomotives. I consider the prices reasonable, but do not care to place one of your type fire boxes in service at this time.

From *London Engineering*, England.

May 7, 1909.

Among the promising forms of construction suggested is the type of locomotive fire box introduced by the Wm. H. Wood Locomotive Fire Box & Tube Plate Co., Fig. 1-2 of a fire box and shell of boiler for consolidation locomotives on the N. Y. Central & Hudson River R. R.

Paper of Mr. J. W. Hobson, read before North Coast Institute of Engineers and Shipbuilders of England. Reprinted in American railway papers.

"In conclusion, I may state that any idea likely to cheapen the cost of the locomotive boiler, lessen its maintenance charges or increase its value as a steam generator would be gladly welcomed by locomotive engineers throughout the world."

Paper read before American Society of Mechanical Engineers.

"Stay bolt maintenance is a sort of intense anxiety to the Motive Power, that the trouble of stay bolts in high pressure locomotive boilers is a permanent factor in the cost of locomotive maintenance, and has an important bearing on the safety of the public. Any innovation intended to increase their durability or reliability is, therefore, worthy of the most careful demonstration and service trial."

Letter of J. F. Deems, Supt. M. P., N. Y. Central & Hudson River R. R. Co.

February 10, 1910.

Beg to acknowledge receipt of your letter of the 8th, relative to the test of Wood Boiler. The dynometer car records have not been analyzed sufficiently to warrant giving out any figures.

Letter of Wm. H. Wood, Engineer.

Media, Pa., February 11, 1910.

'We are entitled to a copy of Mr. Coffin's original report, without it being analyzed. We are in possession of information that during test, engines without boilers used less water and less coal.

Letter of C. Stewes, Gen. Boiler Insp., Intercolonial Railway of Canada.

Moncton, N. B., February 15, 1910.

Concerning your patent corrugated fire boxes and tube plates, I think this arrangement will prove of considerable benefit in eliminating to some extent the cracking of side sheets and of top flange of tube sheet, also the distortion of central portion of tube sheet with resulting tube leakage should be greatly reduced.

The life of the stay bolts should also be very materially increased.

Extracts from Leading Constructing Engineers, Master Boiler Makers and Others

Letter from E. A. Averill.

New York, November 16, 1909.

We have not, as yet, seen or heard of any one who claimed that Mr. Wood's boiler was no good, and so far as that is concerned, I don't expect to hear of anything of the kind.

Letter from J. B. Tate, Boiler Supt., Pennsylvania R. R.

Altoona, Pa., January 22, 1910.

In reply to yours of January 10th, we do not question Mr. Wood as an engineer and constructor, nor do we question his idea of a fire box.

Letter from W. J. Dorna.

New York, May 5, 1910.

I wish to personally compliment you on the production of this valuable development of locomotive boiler.

Mr. Harry D. Vought, New York, N. Y.

Albany, N. Y., June 25, 1910.

Dear Sir:—

Herewith corrected transcript. Please do not publish my remarks relative to the Wood boiler.

Yours truly,
SIGNED: F. A. Linderman.

This proves his remarks were not correct, but they served their purpose to injure us at the Convention.

W. H. W.

Letter from F. M. Patterson, M. E.

Jersey City, N. J., January 28, 1911.

I have your letter of the 24th, and note with a great deal of interest the success you are having with your fire box.

I told you before you started with it that it would revolutionize modern locomotive boiler designs but, of course, it takes time, as you not only have to give them something better than they now have, but you have got to educate the engineers besides.

Letter from C. E. Fuller.

April 21, 1911.

The side sheets in this fire box at the present time are in good condition, but the door sheet and flue sheet are developing cracks. This fire box has given us about the same service as the ordinary fire box gives running in this territory.

P. S.—W. H. W. No stays were broken between the corrugation of this fire box all the time it was in service and the door sheet was the O'Connor patent, which we were requested to put in this box. Mr. Fuller was no friend of this box, as he wanted to countermand the order after it had been given by his predecessor.

American Engineer and Railroad Journal, R. H. Rogers, Editor.

New York, July 14, 1911.

I have your letter of July 11, with copies of letters enclosed, and would say that I fully agree with your statement that the breaking stay bolt zone has become entirely eliminated in the Wood type of fire box.

Letter from D. B. Hines.

Ogden, Utah, October 7, 1911.

Referring to report on Wood's Corrugated Fire Box and also to your letter of July 6th, 1911, on page 26, of October issue of the *Railway Journal*, will say that I have personally inspected the Wood's fire box in boiler in Engine No. 20, in service on the Union Pacific Railway out of North Platte, Nebraska, and I also talked with the boiler inspector. The fire box had been in service about sixteen months, and in that time the tubes had been taken out once. The boiler inspector also told me that there had not been any broken stay bolts in the sixteen months.

P. S.—This was not an entirely new boiler, but a back end, consequently it could not be tested before it left the Baldwin Works, as is usual only as being tight same as a water tank, therefore there would not be a fair indication of what a new complete Wood Boiler would do.

Letter from T. H. Mooney.

San Antonio, Tex., July 19, 1912.

Your idea comes much closer to providing for that which is most needed (expansion, etc.), and I am convinced you have a better box than Jacobs-Shupert.

Letter from D. B. Hines.

West Branch, Ia., October 10, 1912.

I am like Mr. Gillis. He thinks the Wood Fire Box will be all right when given a chance. It is a change in the construction of the same as it was when the air brake started, they said it would not work, and the same with the injector and other things that I could name. The boiler troubles can, and will, be overcome in the Wood design of locomotive boilers.

Letter from Robert Quayle, Chicago & North Western.

March 25, 1913.

"We have all thought very favorable of the fire box and have believed that it was mechanically correct."

"For your information we have recommended to our people one of your fire boxes, and hope to get a favorable reply in the next few days, and then we will not have to depend upon the try-outs of others, but will have it in our own field where we will know for ourselves, and if it is all right, we can probably aid you in giving information to others who wish to give it a try-out."

Mr. M. O'Connor, Boiler Supt.

"You have a most complete fire box, as each sheet in fire box as well as in front tube sheet and flues are provided for to release uniformly the expansion and contractions, which in my opinion will eliminate, to a great extent, the trouble heretofore experienced by in the rigid flanges and uneven expansion of fire sheets. The more I look at your plan of fire box and tube sheets, the better I like it."

P. S.—By Mr. Wood. These are from letters when they did not think the N. Y. Central was using us right.

Letter from F. M. Whyte.

July 30, 1913.

You ask about the Wood Fire Box on the N. Y. Central, and probably more particularly while I was connected with that road, and it gives me much pleasure to say that they give very good service.

It is my general understanding that the stay bolt record of these fire boxes on the N. Y. Central was extremely good, very few bolts having been broken.

Letter from Robert Joy, M. E., Boiler Superintendent.

October 29, 1913.

In reading the various papers of the technical press I note that the Master Boilermakers, in commenting on the merits of the Wood Fire Box, almost invariably refer to the failures of the old corrugated side sheets that were used on some of the Western locomotives some years ago. This is very unfair criticism, to say the least, as the old corrugated sheets referred to, joined a straight crown sheet just below the turn, thus forming a seam with approximately ⅞" thickness of metal, and preventing the very object for which the corrugated side sheets were applied. As a boilermaker, I felt rather shocked at the comparison made by the Master Boilermakers between these old-fashioned corrugated sheets and the Wood Fire Box which I consider one of the most scientific designs of the century.

I thank you for writing me, and trust when you are up this way you will pay us a visit. I feel confident now, as I have felt from the start, that the name of W. H. Wood will be better known at the end of the present century, no matter how tardily the recognition comes.

Letter from J. Kennedy.

New York, November 7, 1913.

Your courteous letter with interesting enclosures is at hand, and I am pleased to note the high praise given by an expert authority on your design of a boiler. I very cordially agree with Mr. Joy that the merits of your adaptation of corrugated sheets to the modern locomotive cannot fail eventually to supersede the antiquated and impossible plans now in vogue. The amazing thing is the delay in getting a fair and full trial, and even the limited trials that you have had are so convincing that one would think that the rapid adoption of your plans would immediately follow.

I am pleased to note that you continue to be of high courage. All things come to them that wait. With best wishes, I am,

J. K.

Extract frm Gillis' report, read before the New York Railway Club.

General Superintendent of Motive Power of the New York Central invited me to ride on some of the engines on that road with corrugated fire boxes. I rode on them for several days at watch time, and so far as I could see, they seemed to be giving very good satisfaction, as everybody on the road seemed to be pleased. Later, I spoke to some of the officers of the road about the matter, especially with reference to broken stay bolts, and was informed that the breakage in stay bolts in these boilers was reduced to a minimum. They had at work two boilers over a year with only 11 broken bolts and 10 cracked ones, and these not between corrugations.

Letter from W. E. Dodds, M. E.

Bristol, Pa., February 21, 1914.

I was glad to have the opportunity to attend the meeting at the New York Railway Club last Friday evening.

The meeting showed me the value and the merit of the corrugated fire box and convinced me that where an article is scientifically correct it will ultimately win out against prejudice, as doubtless occurred to the intelligent men present.

I came away from the meeting convinced that you had the most valuable device that I have ever known of.

Letter from Franklyn Railway Supply Company.

May 4, 1914.

We believe the Wood Boiler as the merit claimed for it, but it is somewhat out of our line for devices now handled for this company.

Letter from Snowden Bell.

New York, May 11, 1914.

"Tate flexible stay bolt" (really the old German design) has been by active business methods extensively exploited.

The Wood Fire Box sheet is, on the other hand, truly flexible, and this capacity of flexibility should, theoretically, make it capable of effectually resisting the strains which overcome the articulated stay bolt. I see no reason why it should not so operate in practice, and have been rather surprised that it has not been more extensively introduced.

Letter from J. Snowden Bell.

New York, September 3, 1914.

I agree with Mr. Wood as to the fallacy of so-called "flexible" stay bolts, but am unable to concur in his view as to the combustion chamber.

Letter from Godfrey Rebmann, V. P., Otis Elevator Company.

November 13, 1914.

My hearty congratulations. Stick to it and you will win out.

Mohammed Hofez, Engineer, Tanta Loco. District, Egyptian State Ry., Tanta, Egypt.

From my point of view, I consider the idea of corrugation as very highly excellent, and it does worth the approval of the Mechanical World's great men, having to relieve them of several troubles. In my opinion a boiler fitted with your patent fire box will do very well, and I thank you for same.

Letter from F. D. Chandler, Banker.

November 16, 1914.

It seems to me that with your engineering, Delaware County will go on the map for having invented one of the most economical contrivances for railway locomotives that has ever been produced.

Harrington Emerson, Esq.

I am interested in your boiler. The steam locomotive is capable of great improvements of design, and I am glad to welcome such betterment as yours.

Letter from Samuel A. Dugan.

March 17, 1915.

I note you have got a good Safety Fire Box. I have been a boilermaker for thirty years, and know what I am talking about.

Letter from Charles T. Apps, M. E.

March 22, 1915.

I am sorry that at this writing I have no pamphlet illustrating the Wood fire box, but I believe it to be the best device yet produced for decreasing the breakage of stay bolts on locomotive boilers.

Letter from John Wood, Jr.

Conshohocken, Pa., April 22, 1915.

I am at a loss to know why all the railroads do not adopt such a great advance in boiler construction.

It certainly will have a much greater life, reducing the constant and troublesome repairs caused by *flat plates* and the present use of a large number of stay bolts, coupled with its greater efficiency and safety, positively makes it a great advance in the motive power of any railroad company. I consider it as much of an improvement over the present type of boilers as the steel passenger coaches are over the old wood ones, or the air brake over the obsolete hand brake.

Extract of Proceedings of the New York Railroad Club.

On the discussion of Mr. Seley's paper on flexible stay bolts, Mr. Thomas Lewis, of the Lehigh Valley Railroad, says in answer to your question asked, "I would look in another direction rather than to use the present form of stay bolts. I would look for some other design in the locomotive fire box rather than the locomotive stay bolts. I believe in flexibility, which is the basis of construction in the Wood Boiler."

Letter from C. H. Hogan, New York Central & Hudson River R. R. Co.

Depew, N. Y., March 5th, 1909.

Referring to your letter of Feb. 26th, relative to our letter of Feb. 24th, with reference to boiler on engines 2490 and 2494.

Engine 2490 has made 10,838 miles, Dec. 5th, 1908, to March 1st, 1909.

Engine 2404 made 5,690 miles Jan. 9th to March 1st, 1909.

Attached please find copy of dumpout record of engine 2492, which went in service Nov. 18th, 1908. This engine has made 11,980 miles to March 1, 1909.

P. S.—Engine 2481 with No. 3 Boiler will leave the shops next week.

You no doubt think me a little slow in answering yours of Jan. 23rd, asking about consumption of coal on locomotives equipped with your boilers.

In order that we might fully determine what the difference was in consumption of coal between the two locomotives equipped with your boilers and the same class of engines equipped with our standard boilers, we had our Road Foreman, who follows up this class of power, make a close investigation and following is what he reports in reference to the consumption of fuel.

"I cannot see that either of these engines burn less coal than any other G-5 engine working under the same conditions. Boilers are new and clean and no steam or water leaking from them at all; valves are square and no blow to engine. On the whole they are working at the present time under the most perfect conditions."

You will note by the above that there is apparently no difference in the consumption of fuel, while Mr. Crandall, Road Foreman, reports the engines working perfectly.

Letter from Fred H. Snell, Locomotive Expert.

Buffalo, March 1st, 1910.

I have been inspecting your patent boilers on the New York Centrail Railroad for over one year.

There are 350 less stay bolts in your boilers, and I can say there has never been a stay bolt broken in any of them since they have been put on the road. Also there were no stay bolt nor mud ring leakages, and no trouble with tubes except that which is usually caused by dump outs, and in running the engines from the dump outs to the Round House.

The engineers who have been running these engines have not reported to me any leakages of tubes while on the road.

Two of your engines were sent to the shop for examination after nine months heavy road service and tubes damaged by bad water conditions were fixed over. I examined them internally and found no more scale than in regular boilers, and condition of fire box and tube plates was first class.

The New York Central made a test in December last by measuring water and coal, and while I was not allowed on the engines, I am in possession of information that our engines used less water and less coal than their engines with the *regular* fire boxes and tube plates.

I have taken daily measurements of coal used since the engines with your boilers have been in operation, and they show conclusively an average saving of over 15 per cent. in the coal bill.

Letter from Fred H. Snell, Locomotive Expert.

March 8th, 1910.

I have inspected engine 2481 fitted with Wm. H. Wood's Loco. Boiler, daily for one year within 20 days of the time she has been in service.

There have been no broken stays, no leaking mud rings, no leaky tubes, only those caused at dump outs.

I have examined the boiler internally and find all in first-class condition.

In engines 2490 and 2494 there were no cracks in tube plates as was reported, nor have I found any in 2481.

I have examined all three internally with torch and chisel and found all in the best condition.

Letter from Charles F. Pierce.

New York, August 29th, 1911.

My object in remaining over a day in Buffalo, was to prove to Mr. Hassett, that the rumors on the 2490 were unfounded, that the boiler was the same as at last inspection.

Therefore, after Mr. Sullivan's inspection, that was cancelled. No report or record made of it.

P. S.—Another report in view of injuring the boiler.

Letter from Charles F. Pierce.

New York, Feb. 1, 1912.

I have been to the New York Central offices numerous times in accordance with the arrangement made.

After Mr. Deems left the matter was taken up by Mr. Smith, General Manager, and Mr. Ingersoll, Assistant General Manager, whose letter I enclose.

He stated the policy adopted by the N. Y. C. Lines of a uniform plain fire box of their own design prevents them from ordering other type of boilers or fire boxes and they have refused to even try the Jacobs-Schupert Fire Box and other boxes presented to them.

They acknowledge the boilers made by Mr. Wood, with Wood Fire Boxes and Tube Plates ordered by Mr. Deems and which are in service between Buffalo and Syracuse on three locomotives, had given good service and were still working, but declined to make any definite report in their favor, preferring not to make any change but stick to the fire box which they could make in their own shops without special parts. The taking of this matter from the Motive Power Dept., by the Operating Dept. has delayed obtaining any report up to this late date. The letter enclosed is the best I could get.

Letter from Alexander S. Lymen, General Attorney, N. Y. C. & Hudson River R. R.

New York, May 7th, 1912.

I herewith enclose copies of reports upon comparative tests made in or about December, 1909, of the Wood Boiler and the standard type, which have been furnished to me by the Motive Power Department.

P. S.—We could not get the copy of the December test, which proved so satisfactory in every way, of our boiler, only through their Attorney. You can see the difficulties put in our way by the Superintendent of Motive Power.

Letter from H. A. Gillis, Mechanical Engineer.

Washington, D. C., Nov. 21, 1914.

I returned from Wilmington yesterday.

The Atlantic Coast Line think very well indeed of your fire box. The great trouble is that their water is of the most excellent character, and they have even obtained permission from the Government to run their flues and fire boxes much longer than the requirements, and, while your fire box has done well, they are not having any serious difficulty with any of their other boxes, so have not had time to make a comparison.

P. S.—This is an excuse in regard to good water and the engines are costing $2600 annually to keep them in repair and as every Superintendent of Motive Power knows two-thirds of this amount goes on the boiler, same as it does on any other road, and 50 per cent. of this can be saved by using the Wood Boiler, without a shadow of a doubt.

Letter from J. N. Hetzel, Asst. Foreman Boiler Maker, Erie Railroad Company.

Meadville, Jan. 22, 1910.

I beg to assure you that I fully appreciate the efficiency of the Wood fire box and tube plate. The writer is sorry he is not in a position to direct the installation of the Wood Fire Box. It is true that the fire box in your circular printed in red ink speak for themselves, but not so much as does the fire box.

It is evident that the Wood fire box cannot help but meet with absolute success. For this reason: That the design is not in accordance with the expansion and contraction of the Wood fire box while working with the most unavoidable conditions.

Letter from R. F. Hoffman.

Danville, Penna., April 24, 1913.

Please accept my thanks for your kindness in the matter and be assured that my experience of the very serious subject leads me only to wish for you the fullest success in the furtherance of your earnest work.

Letter from Chief Mechanical and Civil Engineer, John W. Harkom.

August 25, 1913.

Re the comparative test in which the New York Central report, 1907, was compiled. No favor appears to have been shown the Wood Boiler and on close examination showed the constructions were as far as possible alike on the test drawings.

From Norfolk & Western Ry Co., A. Kearney.

Roanoke, Nov. 25, 1910.

We have had some further correspondence with the N. Y. C. with reference to having fitted up with your fire box in question but our people concluded that it would be well for us to go somewhat slowly and see what develops from the N. Y. C.

P. S.—From W. H. W.

It will be seen from the tone of this letter that the N. Y. C. inferred that something might interfere. The inference to be drawn is social interest in as much as the reports from all other than the main offices were all in favor of the boilers at the works.

Letter from C. W. Kephart, General Supt. M. P., Pennsylvania R. R.

Altoona, Dec. 22, 1911.

Some time ago at your suggestion, we had prepared design of application of your fire box to our class H-8b locomotive and submitted to you prints from the drawings, but we have never yet been able to get anything decisive in this matter. I am sending you today a set of prints from these tracings, as follows:

No. 37945-A—Corrugated Fire Box, Stay, Spacings in Throat Sheet.
No. 37936-A—A Boiler with Corrugated Fire Box, forged details.
No. 37935-A—A corrugated fire box, foundation ring.
No. 37944-A—A detail of fire box, corrugated.

These drawings were not acceptable to be certified by Mr. Wood, who had designed his boiler and knew better what he wanted and he would not be responsible for changes made.

INTENTIONAL SECOND EXPOSURE

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Department of Commerce, Bureau of Standards.

Washington, Jan. 31, 1914.

The bureau has carefully considered the design and construction of your type of fire box and it would seem highly desirable that opportunity should be given so carefully designed and proportioned boiler, believing that the information pertaining to the merits of the fire box would bring it into very favorable notice.

If the bureau could be of assistance or could co-operate in any measure toward bringing the merits of the design to manufacturers it would take great pleasure in so doing.

From the *Railway Master Mechanics' Paper,* published in Chicago.

March issue—1911.

For the past few months it would seem that there has been more than the usual amount of agitation with regard to locomotive boilers and their diseases. Nothing of material value, however, had developed in the way of remedies. At least no radical improvements in construction or design have been generally recommended or adopted. It is true that the flexible boiler for Mallets has become an actuality, but this is a mere adaptation of the ordinary boiler to certain requirements having to do with limitations of rigid length. The disease referred to, and the ones which are costing so much money, are located in the sheets of the fire box.

Admittedly little is known of the strains set up in the sheets of a fire box of present-day design by the effect of expansion and contraction. No one denies that these strains are not properly taken care of, as that person would also have to deny that side sheets crack. Radical improvement is not to be expected by change in materials; it must come from change in shape or form of the sheets. Something in this line has been done by deep thinkers in the field, but their efforts have not met with proper encouragement on the part of motive power officials.

This refers to Mr. Wood's plans.

AMERICAN RAILWAY MASTER MECHANICS ASSOCIATION
LOCOMOTIVE DICTIONARY
1916 Edition

COMMITTEE.
F. H. Clark, B. & O. New York, February 5th, 1915.
A. W. Gibbs, Pa. R.R.
Wm. Schlfage, Erie R.R.
To Wm. H. Wood, Pres.,
Locomotive Fire Box & Tube Plate Company,
Media, Pa.

Dear Sir:—

The above association has authorized the revision of the Locomotive Dictionary. The last previous revision having been made in the year 1912. If you have since made any radical changes in the design or construction in the Locomotive Boilers I shall greatly appreciate the courtesy if you will at once send us full details with illustrations.

This refers to Mr. Wood's last improvements, patented August 11, 1914.

It will be seen from the above that the Superintendents of Motive Power forming this committee of the Master Mechanics' Association include F. H. Clarke, of the Baltimore & Ohio Railroad; A. W. Gibbs, of the Penna. Railroad, and William Schlfage, of the Erie Railroad, representing the Locomotive Dictionary. Why does this representative committee want to publish my work and take no interest for their respective railroads in introducing the Wood Locomotive Boilers, which S. M. Vauclain says have got to be used on all railroads *sooner or later?*

The first part of my work was published in LOCOMOTIVE DICTIONARY in 1912, in full from drawings made for the C. B. & Q. R. R. for blue prints sent us of their type of Boilers.

TESTED, PROVED AND ENDORSED BY ALL LEADING CONSTRUCTING ENGINEERS, MASTER BOILER MAKERS AND OTHERS.

Extract from A. W. Gibbs' letter dated—

A. W. Gibbs, Chief Mechanical Engineer, Pa. R. R.

August 5, 1913.

As I see it, what Mr. Wood has accomplished, in addition to the diminution of the breakage of stays in the side and crown, is the probable reduction in the leakage at the mud ring.

Samuel M. Felton, Pres., Chicago Great Western R. R.

June 25, 1915.

I do not think there is anything of particular advantage to be gained at the moment by your company in varying from its present practices. I have every faith in Mr. Wood's integrity and his ability; certainly there is no question about that.

W. H. Lewis, Supt. M. P., Norfolk & Western R. R. Co.

Dec. 15, 1911.

I have always felt that your fire box possesses some merit and will take an interest in following up the performance of them, but unfortunately we are not in position to render you any material assistance at this time, but it is possible that we may some time in the future be able to do so.

INTENTIONAL SECOND EXPOSURE

Department of Commerce, Bureau of Standards.

Washington, Jan. 31, 1914.

The bureau has carefully considered the design and construction of your type of fire box and it would seem highly desirable that opportunity should be given so carefully designed and proportioned boiler, believing that the information pertaining to the merits of the fire box would bring it into very favorable notice.

If the bureau could be of assistance or could co-operate in any measure toward bringing the merits of the design to manufacturers it would take great pleasure in so doing.

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Spectacular Test of Locomotive Boiler Calculated to Mislead

To the Editor of *Iron Age:*—

I notice in reading your issue of June 27 an account of a spectacular test of a patent Locomotive fire box at Coatesville, Pa. The word spectacular describes it, for no Master Mechanic or Mechanical Engineer could doubt that the construction of the Jacobs-Schupert fire box is about as strong as it would be possible to make it, but on the other hand, people who had no positive knowledge would not know this, the same as the Engineers, that strength only was not the prime object of a locomotive fire box. A certain amount of strength with flexibility is the thing most desired in the construction of a locomotive boiler. Any structure built of 12 or 13 channel sections having the Adamson joint extended to the outer sections of fire box and requiring some 6000 rivets in the jointed sections, must necessarily be stronger than a flat-sided fire box made in the regular way with only 2000 stays to hold the plates together.

There is no danger in heating fire box crown sheets and feeding in the water, unless they have been made so hot as to reduce the tensile strength of the material to at least one-third, when the danger of resistance would be in ratio to the relative strength of the two structures as was proved.

It should be patent to all that the circulation in this construction is interrupted by the plate staying surface, for the apertures cut in same, are the only places for the water to circulate, whereas, in the regular boiler nothing but the stays will impede the progress of circulation. These features together with the collection of mud and scale by the channel sections, whose depth affords the very best kind of a receptacle for the foreign matter in the water, are against this boiler. No matter what strength, etc., was proved in the tests, the construction on account of the difficulties under which a locomotive boiler works, is undesirable.

I have been perfectly familiar with the construction of locomotive boilers for the last forty years, therefore, it occurs to me, as a Mechanical and Construction Engineer, that the making of this test was a waste of time and money, as it does not alter the principles involved nor otherwise give the relief in flexibility with increased fire box surface, so much desired in locomotive boiler construction.

Yours very truly,
Signed: WM. H. WOOD,
Mechanical and Constructing Engineer.

Media, Pa., July 6, 1912.

From Engineering Editor, *Iron Age*, N. Y.

July 8th, 1912.

Your interesting favor of July 6th is at hand. We agree with you perfectly that the tests at Coatesville, Pa., of the locomotive boilers were spectacular and this was our special reason for giving space to them.

J. H. Bickley, M. E., Reading Iron Co., Reading, Pa.

October 12, 1914.

Through the extra strength gained by the flexibility, the stay bolt area will certainly be established, for the U. S. Marine Law allows

50 per cent. greater strength for a corrugated plate than a flat plate and thus the area covered in these improvements can be greater than in the ordinary boiler, with a consequent smaller number of stays.

Mr. Edward Oldman, Boiler Maker, Oldman Boiler Works, Buffalo, N. Y.

Sept. 15, 1914.

I would say that Wood's boiler is far ahead of anything up to the present, for it is practical and correct. There can be no doubt in the mind of any mechanic that the only true way to get over strains set up in fire boxes and tube plates, is by using common sense, flexibility, which is certainly contained in the Wood plans. I saw one of these fire boxes at Buffalo, and there could be no doubt, as expressed by me about its having the only true principle.

Mr. Ben Updike, Philadelphia, Pa.

October 9th, 1914.

I know something about the extra strength obtained by corrugation as I happen to have the first patent ever obtained in the United States for manufacturing corrugated pipe, and, therefore, know well the difference in strength from those made from plain surfaces. I could say more but the general public is on to the importance of the improvements by Wood. I think the railroads should take every advantage in ordering new locomotives in order to cut down expenses, as the present boiler is a serious proposition to keep in repair.

Mr. W. E. Dodds, M. E., Bristol, Penna.

Sept. 17th, 1914.

I attended a meeting of the N. Y. Railway Club, the beginning of this year to hear a paper read by John W. Harkom, a well known railroad man, on "Rigidity vs. Flexibility." This is best in Locomotive Boilers. While no name was mentioned of any designer, the plans discussed were those of Mr. Wood, and with the explanation given and the sketches made they attracted a great deal of attention from the railroad men present, with no arguments against them. It will be seen in the "Proceedings" that not one word went on record to discredit them. Of course, where an article is scientifically and practically correct it is bound to come on top, though handicapped at first by a little prejudice.

G. H. Musgrave, Boston, Mass.

Sept. 19, 1914.

That W. H. Wood's are the only recognizable improvements that have been made in locomotive boilers in years, and they should and will be recognized as such and become the standard of future locomotive boilers on account of the extra strength gained and the absolute control of the expansion and contraction stresses which crack the plates and break the stay bolts. None of these are controlled by our present construction that is sure.

Robert Joy, Supt., Kingsford Boiler & Machine Works, Oswego, New York.

August 31, 1914.

I have no hesitation in stating that the improvements by W. H.

Wood for locomotive boilers are far and away ahead of the others for fulfilling the desired requirements to date, as they are truly flexible and, therefore, dispense with numbers of stays, both flexible and otherwise.

I cannot understand why they have not become used as a standard for it is patent that locomotive boilers will have to have this plan adopted before any relief can come to the railroads in reduced expenses.

J. C. Trefts, Supt., M. E., Farrar & Trefts, Buffalo, N. Y.
September 9, 1914.

I have had some experience with the manufacture of flexible fire boxes in a temporary way and have followed their working, therefore, I am pleased to give my opinion that the improvements by Mr. Wm. H. Wood are both scientific and practical, and on account of the stresses being neutralized by the corrugations, the extra strength and the consequent reduction in stay bolts, they are by far the most advanced improvements.

As to Boiler Troubles

Editor *Railway Journal*:

The locomotive boiler as it exists is a very unsatisfactory product and is very costly to maintain. The trouble that exists is again acknowledged by the committee on locomotive design construction at the Master Mechanics' Convention at Atlantic City this June; whether the boiler is made with or without a full set of flexible stays, and I note the measuring device by McBain & Fowler is to find out something that is known to exist and that cannot be obliterated in present construction, therefore, such matters are deferring only the real issue, "New Construction."

These few remarks are well backed up by the number of patents that are being taken by railroad boilermakers for attachments to try and improve the locomotive boiler, and which are of no earthly use to it. It has been over and over proved that there is no means of ridding locomotive boilers of the trouble which exists only by well defined and specific laws governing the expansion and contraction in forming construction, and which are being used by all kinds of manufacturers where the same evils that exist in locomotive boilers have to be contended with. Therefore the question is not debatable and when a committee of motive power superintendents on design construction of locomotive boilers fail to recognize such facts that are at hand and totally ignore their use, it is to be regretted and shows there is something more than a want of knowledge when they will sit and remain silent on the well-known improvements that are known to exist in the new construction of locomotive boilers, LESS COSTLY.

Something radically is wrong and especially when motive power expenses have reached the abnormal figure of nearly 33 per cent. of the gross earnings of the railroads. Signed: L. MALIN.

The members of the Committee referred to in this letter are:

A. W. Gibbs, Penna. R.R.
M. K. Barnum, B. & O. R.R.
D. R. McBain, N. Y. C. R.R.
R. E. Smith, Atlantic Coast Line.
J. S. Bell, New York City, N. Y.
C. B. Young, C. B. & Q. R.R.

Expenses of Caring for Locomotives on Railroads

Many of the readers of your valuable paper, no doubt, will be very much interested to know the common expenses it takes in dollars and cents to keep a locomotive in operation annually, to say that this amount seems greatly in excess of what it should be, and it is claimed by engineering experts that this can be considerably reduced so as to be in dollars and cents, millions annually for the respective roads.

A writing from Mr. Willard A. Smith, of the *Railway Review,* speaking before the *Western Railway Club,* he said fuel saving is extremely important. I would not depreciate it in the least, but its relative importance has changed very much within a few years. We find that during the past year maintenance cost of American Railroads took between thirty-one and thirty-two per cent. of their entire gross revenues, while the transportation which involved the entire operation of the road and included fuel as well as other supplies of that kind, only took an average of about 25 per cent., you see how things are shifting. Maintenance costs have increased right along and are *increasing right along,* in spite of everything that can be done. Apparently there has not been much accomplished in attempting to reduce the proportion of gross revenue they consume, therefore, it is up to the railroads to increase the efficiency of operation to get more out of their plants. You will recall that a year or two ago one of our large western railroads had an investigation made regarding *locomotives* as to the time in *which they were* doing work. The average locomotive on that road—and it is not different from any other large system—was actually doing work, earning money by hauling traffic, *four and one-half hours* out of the *twenty-four hours.* It spent something like six hours in the round house, which would give ample time for overhauling the stokers and other appliances out of the twenty-four, and it spent seven and one-half hours undergoing heavy repairs. This is the way the average locomotive on the road spends each twenty-four hours.

Now if conditions are such that you can only get actual work out of a locomotive for four and one-half hours, out of the twenty-four, is it not of the utmost importance that you should get all the work possible out of it during those *four and one-half house?* Of course, it is important to change the conditions and keep your machines working a greater length of time, if it is possible to do so, but there are railroad companies that have worked on that for years without making *appreciable improvements,* therefore, anything that will greatly add to the efficiency of the locomotive during the short time that it is doing actual work *will add enormously to the revenue* of the railroad company. It seems to me that, that is a consideration to which the mechanical men should give their best *thought* and that they should *not hesitate* to recommend to their superior officers when anything of this kind comes up, that they should spend money to save money; because if there is any principle that has been thoroughly established in America's railway management during the past few years, it is that economy and efficiency can only be *secured by spending money liberally to bring it about.*

These remarks coming from Mr. Willard A. Smith, are undoubtedly taken from Records, and it is well to have them made public, for it shows undoubtedly that the range of engineering skill with the R.R. is not sufficient *to bar outside skill* that is known to have gotten up improvements that they don't happen to be interested in and, therefore, cannot be allowed to come into use to *reduce the expenditures* that Mr. Smith speaks of as continually increasing all the time which is surely a *serious proposition* for the *presidents* of all railroads and especially where he does not use his prerogative with the head of the different departments. So long as a president allows the discretion to be entirely with these heads—such things that are developed from railroad men will *have to be used* and the outside *engineering skill,* no matter how it may be endorsed, by hundreds of the best engineers, boilermakers and laymen, *cannot be used.*

As to why the locomotive is so expensive the general public does not know, but all can realize that wherever there is trouble there is a cause. The locomotive engines had not become so much of a complex construction until recently, being burdened with quite a number of subterfuges in the form of

attachments protected by minor patents, but all add to the cost of maintenance. It is true the engines have been made more powerful and the boilers to correspond, and as constructed are an expensive proposition. The locomotive should not be of a complex character in itself. We will ask where comes this great expense in maintenance? It has been explained, from time to time, that the engine parts are not nearly so troublesome to keep in repair as the boiler, which is the *prime mover,* for without this the engine cannot move; hence, it must be on this account that the troubles Mr. Smith refers to in the increase of operating expenses is due. In view of the foregoing, it would show how railways should *welcome the study of outside engineering experts,* who have devoted time and experience and money to subjects that are not scarcely possible for any railroad man in office to do.

Below is a list of the railroads' expenses taken from the last reports of their respective roads to keep a locomoive in repair annually, which included repairs, depreciation and renewals in most cases.

Pennsylvania R.R.	$4,258.39
New York Central & Hudson River R.R...	$4,975.57
Philadelphia & Reading R.R............	$3,189.77
Baltimore & Ohio R.R..................	$3,156.62
Atchison, Topeka & Santa Fe R.R.......	$4,176.90
Lehigh Valley Railroad Co.............	$2,871.16
Chicago, Burlington & Quincy R.R........	$2,579.41
Chicago & North Western R.R..........	$2,616.50
Chicago & Great Western R.R..........	$2,937.41
Southern Railroad	$3,001.68
Central Railroad of New Jersey..........	$3,010.24
Atlantic Coast Line	$2,528.56
New York, Ontario & Western R.R.......	$2,788.95
Union Pacific R.R.	$3,500.11

WILLIAM H. WOOD,
Mechanical and Constructing Engineer,
Media, Pa.
Member of the Western & New York Railway Club.
Feb. 11th, 1915.

Note

Information Given Out

New York Central Test, No. 907, of December, 1909

Motive Power Men's Report guarantees the use of WOOD'S boilers and shows, by series of tests, a saving of 7 per cent. in coal during test of 4 years.

WOOD'S boilers were never out of service during the test, only at shopping times.

REGULAR boilers running against them were out for repairs from 2, 4 and 6 weeks at a time, between their shopping time.

Pacific Type of Boiler, with WOOD'S Fire Box and Combustion Chamber, drawing by Baldwin's, shows 20 per cent. of extra heating surface. Additional heating surface which guarantees 15 per cent. saved in coal.

15,000,000 tons of coal can be saved annually by standardizing WOOD'S Fire Boxes and Tube Plates.

Railway Review, Page 7, issue January 4th, 1919, illustrates Motive Power Men's Standardized Locomotives. Types 2-10-2 and 2-8-2 with Boilers, Rigid Types, having 346 square feet of heating surface in Fire Boxes.

QUESTION: Would it be better if 20 per cent. surface was added to the Fire Boxes, if they were made flexible, if 800 less stays were used, and if strength to the boiler was added 8 to 1?

Final

My business for 32 years, in constructing all classes of machinery, which has been in operation, all over the United States and Foreign Countries, gave me good satisfaction and these improvements on locomotive boilers was to be the climax of my engineering work and which has been the only thing that has caused me any discomfort, more so, from the fact, I had a circular printed, with the clear statements on it, as to what was to be gained by my balanced boiler construction before the boilers were built and tested (*which proved correct on test*).

STANDARDIZE BOILER CONSTRUCTION TO SAVE COAL

(Copied from *Railway Review,* issue of July 22, 1922. page 119).

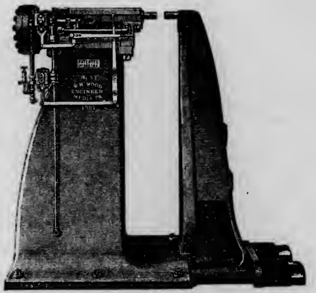
Editor *Railway Review*:

I read in your issue of May 20th, of a movement which should be welcomed by the stockholders of all railroads. I refer to the proposition of saving fuel by means of impressing the different operating divisions with the importance of saving fuel and creating a friendly rivalry between these divisions and individual enginemen to see who can make the most economical fuel performance. No predetermined fuel saving can be made by this method, and, at best, this saving is trifling compared with well-known methods of saving fuel by improved locomotive boiler construction.

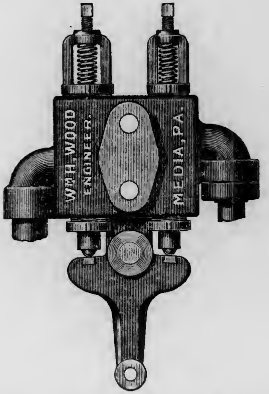
There are direct methods in boiler construction which add to the saving of fuel, as well as adding strength to the boilers, and it is a well-known fact that where twenty per cent. could be added to the area of fireboxes and combustion chambers a direct saving of fifteen per cent. of coal shoveled into the fireboxes could be saved. If this is figured out, it will be found to be a saving of 15,000,000 tons of coal, which is now being wasted annually by the present boiler construction.

Railroad executives might get permanent improvement in fuel economy by appointing a committee of railroad men to consult with well-known engineers as to standardizing boiler construction for saving coal, which is of the greatest importance to all roadroad stockholders in reducing operating expenses.

WM. H. WOOD.



The First Hydraulic Riviter, built by Wm. H. Wood, 33 Years Ago.



The Latest Improved Hydraulic Balanced Valve.

23283

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